

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application of Takahashi et al.

Confirmation No: 3864

Filed: February 24, 2005

Group Art Unit: 1792

Application Serial No.: 10/525,443

Examiner: Elizabeth A. Burkhart

For: *METAL SULFIDE THIN FILM AND METHOD FOR PREPARING THEREOF*

March 15, 2010

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Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

**APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. § 41.37**

Sir:

This Appeal Brief is filed pursuant to the "Notice of Appeal to the Board of Patent Appeals and Interferences" filed on November 24, 2009.

**REAL PARTY IN INTEREST**

The real party in interest is Suzuki Motor Corporation, Shizuoka, Japan, the Assignee of this application.

**RELATED APPEALS AND INTERFERENCES**

Appellants are aware of no appeals or interferences that would be affected by the present appeal.

**STATUS OF CLAIMS**

Claims 1, 8, 10, 11, 13 and 15 are pending in the present application as of the filing date of this Brief. Claims 2-7, 9, 12 and 14 are canceled. Claims 1, 8, 10, 11, 13 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Takahashi et al. (2000) *J. Mater. Sci.*

**10:2346-2348** ("Takahashi et al.") in view of Sasaki et al. (1999) *J. Mater. Sci. Lett.* **18:1193-1195** ("Sasaki et al."). The specifics of this rejection are set forth in the Final Office Action

mailed August 24, 2009 ("the Final Action") and the Advisory Action mailed October 30, 2009 ("the Advisory Action"). Appellants appeal the final rejection of claims 1, 8, 10, 11, 13 and 15.

### **STATUS OF AMENDMENTS**

All amendments made by Appellants during prosecution have been entered as indicated in the Final Action.

### **SUMMARY OF THE INVENTION**

In general, the claimed invention, is directed to a method of preparing a metal sulfide film.

Claim 1 is directed to a method of preparing a metal sulfide film comprising the steps of providing a metal halide as a first raw material and a thioamide as a second raw material, vaporizing the metal halide and thioamide compound and reacting the metal halide and thioamide compound at atmospheric pressure as supported at page 3, lines 14–23 of the specification, in a film forming section as supported at page 6, line 22–page 7, line 2 of the specification and FIG. 1, at a temperature as supported at page 9, lines 11–14 of the specification on a substrate.

Claim 8 is directed to a method for preparing a metal sulfide film comprising the steps of providing a metal halide and a thioamide to produce a metal sulfide film on a substrate, as well as producing a triazine compound as supported at page 4, lines 6 and 7 of the specification.

Dependent claims 10, 11, 13 and 15 are directed toward particular embodiments of independent claims 1 and 8. Claim 10 more particularly sets forth the thioamide compound and the triazine compound of claim 8 as thioacetamide and trimethyltriazine, respectively, and claim 11 more particularly sets forth the reaction between the thioacetamide compound and the metal/iron halide of claim 8, as supported at page 12 of the specification and FIG. 4. Claims 13 and 15 more particularly set forth the metal halide and the metal/iron sulfide film of claims 1 and 8, as an iron halide and a pyrite film, respectively, as supported in the Examples.

## **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

Whether claims 1, 8, 10, 11, 13 and 15 are unpatentable under 35 U.S.C. § 103(a) over Takahashi et al. in view of Sasaki et al. as set forth in the Final Action and the Advisory Action.

## **ARGUMENT**

### **I. Legal Standard for Obviousness**

The Examiner submits that claims 1, 8, 10, 11, 13 and 15 are unpatentable over Takahashi et al. in view of Sasaki et al. A determination under § 103 that an invention would have been obvious to someone of ordinary skill in the art is a conclusion of law based on fact. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1593, 1 U.S.P.Q.2d 1593 (Fed. Cir. 1987), *cert. denied*, 107 S.Ct. 2187. After the involved facts are determined, the decision maker must then make the legal determination of whether the claimed invention as a whole would have been obvious to a person having ordinary skill in the art at the time the invention was made. *Id.* at 1596. The United States Patent and Trademark Office ("USPTO") has the initial burden under § 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

As stated in the recently published Examination Guidelines for Determining Obviousness, "the Supreme Court reaffirmed the familiar framework for determining obviousness as set forth in *Graham v. John Deere Co.*..." (Examination Guidelines for Determining Obviousness Under 35 U.S.C § 103 in view of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.* Federal Register Vol. 72, No. 195, 57526-57535, 57526). Hence, and as long established under that framework, to establish a *prima facie* case of obviousness, three requirements must be satisfied (M.P.E.P. § 2143). First, the prior art relied upon, coupled with the knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references. *In re Oetiker*, 24 U.S.P.Q.2d 1443, 1446 (Fed. Cir. 1992); *In re Fine*, 837 F.2d at 1074; *In re Skinner*, 2 U.S.P.Q.2d 1788, 1790 (Bd. Pat. App. & Int. 1986). Second, the proposed modification or combination of the prior art must have a reasonable

expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *See Amgen, Inc. v. Chugai Pharm. Co.*, 927 F.2d 1200, 1209, 18 U.S.P.Q.2d 1016, 1023 (Fed. Cir. 1991). Third, the prior art reference or combination of references must teach or suggest all of the limitations of the claims. *See In re Wilson* 424 F.2d 1382, 1385, 165 U.S.P.Q. 494, 496 (CCPA 1970) (“All words in a claim must be considered in judging the patentability of that claim against the prior art”).

As discussed above, the prior art reference or references when combined must teach or suggest *all* the recitations of the claims, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. M.P.E.P. § 2143. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. M.P.E.P. § 2143.01, citing *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). As emphasized by the Court of Appeals for the Federal Circuit, to support combining references, evidence of a suggestion, teaching, or motivation to combine must be **clear and particular**, and this requirement for clear and particular evidence is not met by broad and conclusory statements about the teachings of references. *In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). In an even more recent decision, the Court of Appeals for the Federal Circuit has stated that, to support combining or modifying references, there must be **particular** evidence from the prior art as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed. *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000).

Appellants respectfully submit that the instant claims are patentable over the cited reference because the cited reference fails to disclose or suggest all of the recitations of the instant claims, and that it would not have been obvious to make and use, with expectation of success, that which is claimed based on the disclosures of the cited prior art.

## **II. The Rejection**

The Examiner sets forth in the Final Action and in the Advisory Action that, in view of the discussion by Sasaki et al., it would have been obvious to take and use the temperature conditions of Sasaki et al. in the method of Takahashi et al. to prepare a pure pyrite film at lower temperatures than those as set forth by Takahashi et al. and thus achieve the method of the invention. The Examiner submits that although Takahashi et al. describes a method of depositing pyrite using CVD at atmospheric pressure and Sasaki et al. describe a method of depositing pyrite using low pressure MOCVD, Sasaki et al. teach that high partial pressure of sulfur can be a critical factor to prepare pure pyrite and once this condition is satisfied, a pure pyrite phase can be prepared by other methods (*see*, p. 1193, col. 1 of Sasaki et al.). The Examiner further submits that Sasaki et al. disclose a relationship between Fe/S ratio, the growth temperature and the phases of pyrite (*see*, FIGS. 1–3, p. 1195, col. 2). As such, the Examiner alleges that Sasaki et al. suggest that the temperature range and Fe/S ratio utilized would be suitable or could be extrapolated to other methods, including the method of Takahashi et al., and thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the conditions of Sasaki et al. (Fe/S and temperature range) in the method of Takahashi et al. to form a pure pyrite film in order to achieve the method as presently claimed.

## **III. Claims 1, 8, 10, 11, 13 and 15 are patentable over Takahashi et al. in view of Sasaki et al.**

The disclosures of Sasaki et al. describe a method for preparing a pure iron pyrite film by a method other than low pressure MOCVD using  $\text{Fe}(\text{CO})_5$  and TBDS. The method described by Sasaki et al., is also a low pressure (*in vacuo*) vapor deposition method, that uses elemental iron and sulfur as reactants. However, in view of this disclosure, the Examiner alleges that Sasaki et al. broadly teaches and suggests that *any other method of vapor deposition* may be used to prepare a pure pyrite film, so long as the Fe/S flux ratio exceeds 6.8 and the temperature is above 573°K (648°C). Appellants respectfully disagree and assert that this is not the case. Although Sasaki et al. may well describe a method other than low pressure MOCVD using  $\text{Fe}(\text{CO})_5$  and

TBDS to prepare a pure pyrite film and describe conditions required using Fe and S to do so, Appellants submit that there is no disclosure or suggestion by Sasaki et al. that these conditions, which may be appropriate for preparing a pure pyrite film by double source vacuum vapor deposition or other *in vacuo* methods, are broadly applicable to any and all methods of vapor deposition to prepare a pure pyrite film.

The disclosures of prior art references must be considered in its entirety, i.e., as a whole, including portions that lead away from the claimed invention. See *W.L. Grace & Associates v. Garlock, Inc.*, F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (*see*, M.P.E.P. § 2141.02). While the Examiner alleges that Sasaki et al. broadly teach and suggest that any other method of vapor deposition may be used to prepare a pure pyrite film, including atmospheric pressure CVD, so long as the conditions of Fe/S flux ratio and temperature as set forth above are met, the disclosures of Takahashi et al., which were published after the disclosures Sasaki et al., point out that the various methods of preparing pure pyrite films reported were as a whole are performed *in vacuo*, and as such are costly, and the growth rate too slow to be applied to industrial production (*see*, Introduction and Table 1 of Takahashi et al.). Thus, the disclosures of Takahashi et al. indicate that conditions for using atmospheric CVD to prepare a pure pyrite film were not generally within the grasp or known to of one of ordinary skill in the art at the time of the disclosures of Sasaki et al., and indicate that the disclosures of Sasaki et al. were not considered to be applicable to or could be extrapolated to vapor deposition methods for preparing a pure pyrite film that are not performed *in vacuo*.

Furthermore, while Sasaki et al. may demonstrate a method for preparing pure pyrite film using double source vacuum vapor deposition of iron and sulfur powder, so long as the Fe/S flux ratio is greater than 6.8 and the temperature is greater than 300°C (573°K), Sasaki et al. also admit that there are problems with the formation of marcasite when preparing pyrite films by low pressure MOCVD at temperatures below 723°K (450°C) (*see* p. 1193, second to last paragraph of Sasaki et al.). Thus, while Sasaki et al. may describe a method for preparing a pure pyrite film by double source vacuum deposition at temperatures above 573°K using elemental iron and sulfur, Sasaki et al. clearly do not suggest that such conditions, that are suitable for double source

vacuum vapor deposition, are necessarily broadly suitable for preparing a pure pyrite film by any other method of vapor deposition, such as the atmospheric CVD method of the present invention.

The method of the present invention is related to atmospheric pressure CVD using a metal halide and a thioamide as reactants at temperatures of 375°C to 425°C. The reactants in the method of the present invention are clearly different from the reactants described in the method of Sasaki et al. While Sasaki et al. indicate that the Fe/S flux ratio is critical in the preparation of a pure pyrite film by double source vacuum vapor deposition using elemental iron and sulfur as reactants, this ratio, as one of skill in the art will appreciate, is not directly applicable to or could be extrapolated to the reactants (metal halide and thioamide) in the method of the present invention.

In a previous paper, the Examiner had set forth a rejection of claims 1, 9 and 13 under 35 U.S.C. § 103(a) as being unpatentable over Takahashi et al. in view of Schleich and Chang (*see* Office Action mailed August 27, 2008). This rejection was withdrawn by the Examiner in view of Applicants' persuasive arguments set forth in the amendment of December 2, 2008. By the admission of the Examiner, "[t]here would have been no motivation to combine the temperature ranges of Schleich and Chang with the disclosure of Takahashi et al. since Schleich and Chang teach a low pressure CVD method utilizing different reactants than the atmospheric pressure CVD method of Takahashi et al. and provides no suggestion that the temperature ranges utilized in their low pressure process would be suitable for any other deposition process, such as atmospheric pressure CVD." (*see*, page 2, Office Action mailed March 6, 2009).

Thus, in view of the discussion presented above, Appellants submit that while the disclosures of Sasaki et al. may well provide teaching and suggestion that conditions regarding Fe/S flux ratio and temperature are critical to preparing a pure pyrite film using *in vacuo* vapor deposition methods, Appellants reiterate that there is no teaching and suggestion in the disclosures of Sasaki et al., as with the disclosures of Schleich and Chang, that the conditions set forth by Sasaki et al., and in particular, temperature when using an *in vacuo* vapor deposition method, would be suitable for atmospheric CVD methods for preparing a pure pyrite film.

By the admission of the Examiner, the disclosures of Takahashi et al. do not teach a method of preparing a pure pyrite film from a metal halide and a thioamide using atmospheric

CVD at a growth temperature of 375–425°C. As discussed hereinabove, the disclosures of Sasaki et al. do not describe or suggest a method of preparing a pure pyrite film using atmospheric CVD at the temperatures as claimed. As such, Appellants submit that the Examiner has failed to establish a case for *prima facie* obviousness, in that the disclosures of Takahashi et al. and Sasaki et al., either alone or in combination, do not teach all the elements of the instantly claimed method, and that the disclosures of Sasaki et al. do not provide the teaching, motivation and suggestion that a pure pyrite film could be prepared using atmospheric CVD at the temperatures as claimed without the impermissible hindsight of the disclosures of the present application. In view of the foregoing, Appellants assert that the instant claims are patentable over Takahashi et al. in view of Sasaki et al., and respectfully request that the present rejection be reversed on appeal.



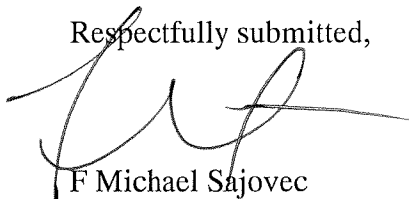
Attorney Docket No. 5576-177  
Application Serial No.: 10/525,443  
Takahashi et al.  
Filed: February 24, 2005

### CONCLUSION

In light of the entire record and the above discussion, Appellants respectfully submit that the instant claims are patentable over the cited prior art. Accordingly, Appellants respectfully request that this case be passed to issuance.

No fee is believed to be due with the filing of this paper. Appellants believe that this amount is correct. However, the Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-0220.

Respectfully submitted,



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### **CERTIFICATION OF ELECTRONIC TRANSMISSION**

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**CLAIMS APPENDIX**

**APPENDIX A** as filed Appellants' Brief on Appeal on September 8, 2008 presents a listing of the claims at issue as finally rejected in the Final Action.

**EVIDENCE APPENDIX**

None.

**RELATED PROCEEDINGS APPENDIX**

None.